

US007984990B2

(12) United States Patent

Bandhauer et al.

(10) Patent No.:

US 7,984,990 B2

(45) **Date of Patent:**

*Jul. 26, 2011

(54) OPHTHALMIC LENS WITH MULTIPLE PHASE PLATES

(75) Inventors: **Mark H Bandhauer**, Orange, CA (US); **Alan J Lang**, Long Beach, CA (US)

73) Assignee: Abbot Medical Optics Inc., Santa Ana,

CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

(21) Appl. No.: 12/566,348

(22) Filed: Sep. 24, 2009

(65) **Prior Publication Data**

US 2010/0014049 A1 Jan. 21, 2010

Related U.S. Application Data

(63) Continuation of application No. 12/323,126, filed on Nov. 25, 2008, now Pat. No. 7,922,326, which is a continuation of application No. 11/259,534, filed on Oct. 25, 2005, now Pat. No. 7,455,404.

(51) Int. Cl.

G02C 7/06 (2006.01)

G02C 7/04 (2006.01)

G02B 27/44 (2006.01)

A61F 2/16 (2006.01)

(52) **U.S. Cl.** **351/168**; 351/161; 351/171; 351/172; 359/565; 359/571; 623/6.3

See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

3,722,986 A 3/1973 Tagnon 4,340,283 A 7/1982 Cohen (Continued)

FOREIGN PATENT DOCUMENTS

EP 37529 A1 10/1981 (Continued)

OTHER PUBLICATIONS

"Optical Design," Military Standardization Handbook, 1962, Chapter 4, U.S. Department of Defense MIL-HDBK-141, 4-1-4-19.

(Continued)

Primary Examiner — Scott J Sugarman (74) Attorney, Agent, or Firm — Abbott Medical Optics Inc.

(57) ABSTRACT

An ophthalmic lens for providing a plurality of foci includes an optic having an anterior surface, a posterior surface, and an optical axis. The ophthalmic lens has a first region and a second region. The first region has a first refractive optical power and includes a first base curvature having a finite first radius of curvature and a first phase plate having at least one diffraction order with a diffractive optical power. The first region is configured for forming a first focus and a second focus. The second region has a second refractive optical power and includes a second base curvature having a finite second radius of curvature that is different from the first radius of curvature and a second phase plate having at least one diffraction order with a diffractive optical power. The second region is configured for forming a third focus that is between the first focus and the second focus. The ophthalmic lens may be configured so the first focus provides distant vision, the second focus provides near vision, and the third focus provides intermediate vision.

11 Claims, 9 Drawing Sheets

